

Claims

What is claimed is:

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- [c1] An oil storage and offtake system, comprising:
a storage tank attachable to a seabed and adapted to store hydrocarbons therein;
at least one fluid channel having a first end positioned inside of the tank proximal a bottom of the tank and a second end in fluid communication with seawater outside of the tank;
at least one offload line having a first end coupled to and in fluid communication with the tank proximal a top of the tank and a second end adapted to be fluid coupled to a tanker and accessible from a water surface; and
at least one hawser having a first end operatively coupled to the tank and a second end adapted to be accessible from the water surface and attachable to the tanker to anchor the tanker during offtake operations.
- [c2] The system of claim 1, wherein the tank is adapted to store oil on water in the tank, the water in fluid communication with a seawater environment outside of the tank, a level of water in the tank corresponding to an amount of oil pumped into and withdrawn from the tank.
- [c3] The system of claim 1, wherein the second end of the at least one fluid channel is disposed at a location away from the seabed.
- [c4] The system of claim 1, wherein the at least one offload line comprises a substantially rigid lower portion coupled to the tank and extending therefrom to a selected depth below the water surface, and a flexible upper portion coupled to and in fluid communication with the lower portion and extending therefrom to proximal the water surface.

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- [c5] The system of claim 4, wherein the lower portion comprises a top-tensioned riser.
- [c6] The system of claim 5, wherein the riser is maintained in tension by a subsurface buoyant device coupled to the riser.
- [c7] The system of claim 6, wherein the flexible upper portion of the at least one offload line is coupled proximal one end to a surface buoyant device for access from the water surface.
- [c8] The system of claim 7, wherein the first end of the at least one hawser couples to the riser, the second end of the at least one hawser couples to the surface buoyant device, and the at least one hawser has a length less than a length of the flexible upper portion of the at least one offload line.
- [c9] The system of claim 8, wherein the first end of the at least one hawser couples to the subsurface buoyant device.
- [c10] The system of claim 8, further comprising at least one coupling device between the riser and the first end of the hawser adapted to allow substantially free relative rotation of the hawser with respect to the riser.
- [c11] The system of claim 7, wherein the flexible upper portion of the at least one offload line comprises a hose.
- [c12] ~~The system of claim 6, wherein the subsurface buoyant device is located at a depth below the water surface substantially unaffected by waves and surface currents less than waves and surface currents of a selected storm magnitude.~~
- [c13] The system of claim 12, wherein the selected storm magnitude is a 1-year storm magnitude for a particular sea state.

- [c14] The system of claim 12, wherein the selected storm magnitude is a 10-year storm magnitude for a particular sea state.
- [c15] The system of claim 6, wherein the subsurface buoyant device is located at least about 50 feet below the water surface.
- [c16] The system of claim 15, wherein the subsurface buoyant device is located at least about 200 feet below the water surface.
- [c17] The system of claim 6, wherein the subsurface buoyant device comprises an opening therein to accommodate coupling of the upper portion of the offload line with the riser.
- [c18] The system of claim 17, further comprising a coupling device between the riser and the subsurface buoyant device adapted to allow rotation of the subsurface buoyant device with respect to the riser.
- [c19] The system of claim 17, further comprising at least one coupling device between the riser and the first end of the upper portion of the offload line adapted to allow substantially free relative rotation of the upper portion of the offload line with respect to the riser.
- [c20] The system of claim 1, further comprising weighting material disposed in the tank, the weighting material having sufficient weight to overcome buoyancy forces on the tank when the tank is filled to a capacity with hydrocarbons.
- [c21] The system of claim 20, wherein the weighting material comprises sand.

[c22] The system of claim 1, further comprising weighting material attached to the tank, the weighting material having sufficient weight to overcome buoyancy forces on the tank when the tank is filled to a capacity with hydrocarbons.

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[c23] ~~The system of claim 1, wherein the storage tank is an atmospheric pressure vessel having a box-shaped configuration with a web-framed steel structure.~~

[c24] The system of claim 1, wherein the capacity of the tank is greater than 500,000 barrels.

[c25] The system of claim 24, wherein the capacity of the tank is around 750,000 barrels.

[c26] The system of claim 1, wherein that tank comprises dimensions of around 200 feet long, around 200 feet wide, and around 150 feet tall.

[c27] An oil storage and offtake system comprising:
a storage tank attachable to a seabed and adapted to store hydrocarbons therein;
at least one fluid channel having a first end positioned inside of the tank proximal a bottom of the tank and a second end in fluid communication with an environment proximal the outside of the tank away from a base of the tank;

a tensioned riser in fluid communication with the tank, the riser having a first end coupled to the tank proximal a top of the tank, the riser extending therefrom to a second end at a selected depth below a water surface, the riser coupled proximal the second end to a subsurface buoy to maintain the riser in tension;

a flexible hose in fluid communication with the riser, the hose having a first end coupled to the second end of the riser, the hose having a second end coupled to a surface buoy and accessible from the water surface, the second end of the hose adapted to fluid couple to a tanker;

at least one hawser having a first end coupled to the second end of the riser and a second end coupled to the surface buoy and accessible from the water surface, the hawser having a length less than a length of the hose, the second end of the at least one hawser adapted to attached to the tanker to moor the tanker during offtake operations;

at least one coupling device between the second end of the riser and the first end of each of the hose and the hawser adapted to allow substantially free relative rotation of the hose and the hawser with respect to the riser; and

weighting material disposed in the tank, the weighting material having sufficient weight to overcome buoyancy forces on the tank when the tank is filled to a capacity with hydrocarbons.

[c28] The system of claim 27, wherein the weighting material comprises sand

[c29] The system of claim 27, wherein that tank comprises dimensions of around 200 feet long, around 200 feet wide, and around 150 feet tall and has a capacity of about 750,000 barrels.

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